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SUSTAINABLE DISTRIBUTION PRACTICES AND ENVIRONMENTAL PERFORMANCE AMONG CHEMICAL FIRMS IN MALAYSIA

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INTRODUCTION

The increasing influence of logistics and distribution services in moving Malaysia's economy which is derived by the globalizations and changing of world trade had dramatically created impact on environment. Legislation has been effective in improving environmental conditions, but emission of pollutants to atmosphere are still discharged in considerable amounts (3.4 billion tons) in 2017 in Malaysia alone (DOSM, 2017). The largest contribution to this pollutants (70.4%) was from car and vehicle (logistics & distribution).

Chemical firms have started to green their operations in order to help their customers to be better prepared for predictable and future green demand from both market and government legislations. Chemical firms in Malaysia is also one of the most developed chemical industries of the world. The industry is not only capable of fulfilling the nation's requirement of chemical products but also exports its chemical products to the countries like Japan, Hong Kong, China, Singapore, Thailand and even U.S.A. The areas in which the chemical industry in Malaysia is specially advanced are the Petrochemicals and Oleo Chemicals (Omar & Othman, 2016).

The chemicals' industry's approach to encourage compliance with existing regulations and to improve its public image come in the form of an initiative called the Responsible Care Programed (RCP) which was launched in 1994. This program is designed to show that the industry can voluntarily put into place measure for the effective management of the hazard that come with the use and handling of chemicals. RCP is a collective name that applies to a statement of policy, guiding principles, a national advisory panel, a chemical referral center (since replaced by a Web site), a verification process, and six codes of practice (CICM Malaysia, 2007). One of the practice is distribution code of practices which will be discuss further in this study is a crucial

importance since there are several incidents involving distribution practices reported in recent years. Some example of chemical incident involving transportation and distribution in Malaysia includes:

i. A lorry carrying 23 tanks of hydrochloric acid rammed into the back of another lorry heading in the same direction in Melaka. (17August 2005)
ii. A truck carrying 24 tanks of nitric acid and hydrochloric acid overturned at Machang. (26 December 2013)
iii. 11 people suffered burns including 3 critically injured in a fire believed triggered by a spillage from an oil storage tank at a petrol station in Dataran Shell at Gua Musang. (2 April 2014)

(sources: Ministry of Natural Resources and Environment (NRE), 2016)

Hence, this study tries to investigate the level of sustainable distribution practices implementation and its relationship with environmental performance among Malaysian chemical firms which will represent the Malaysian Chemical Industry.

LITERATURE REVIEW

Sustainable Distribution Practices

Distribution is an important activity in the integrated supply-chain management. With the globalization of the chemical industry, various individuals and organizations from locations around the world are generally responsible for handling, storage and distribution of such products.

Sustainable distribution practices has given priority because of the greatest potential exposure of the public to chemicals when they are being transported and distributed from the ports and from the chemical manufacturers to the various customers (Cefic, 2007). The large number of road accidents and the congestion on Malaysian roads also makes the sustainable distribution practices of prime benefit to the society as a whole. In chemical industry, the firms who were commits with the RCP implements the distribution code of management practices and applies to all modes of transportation. The code also applies to distribution activities (storage, handling, transfer and repackaging) while chemicals are in transit between companies and their suppliers and customers. So, the purpose of this distribution code of management practices is to reduce the risk of harm posed by the distribution of chemicals to the general public, carrier, distributor, contractor, the chemical industry employees; and the environment (CICM Malaysia, 2007). The code will promote improvements in:

i. The safety performance of carriers and other providers of distribution services.
ii. Employee preparedness and awareness in preventing distribution emergencies.
iii. The public's preparedness in responding to chemical distribution emergencies.
iv. The public's understanding of, and confidence in industry.

Kim (2012) highlighted that one of the most influential ways of reducing environmental impact in the business area is to restructure the logistics process. By changing the current logistics structure into a more environmentally friendly one, a firm may eliminate waste in the logistics operation which may lead the firm to consume less energy.

This study adapted measures from Responsible Care Code of Practices (RCCP) of the distribution code of management practices in measuring the sustainable distribution practices (CICM Malaysia): There are five measures used:

i. Develop and produce chemicals that can be manufactured and transported of safely.
ii. Evaluate the risks associated with chemical distribution and methods to reduce those risks.
iii. Meet or exceed all regulations and industry standards governing chemical distribution.
iv. Provide emergency advice and/or assistance to people on the scene in the event of a chemical distribution emergency.
v. Develop new technologies and methods to improve chemical distribution safety.

Sustainable Distribution and Environmental Performance

Distribution have an important role to play in ensuring the sustainability message is passed on through to the customer, while of course they also need to ensure their own operations meet sustainability goals. The chemical industry also promotes excellence in distribution operations, with the aim of achieving even more efficiency and making better use of available transport and logistics resources.

The growing demand of customers and environmental societies for more environmental friendly products have led 'green' becomes a common practice to portray the environmental friendly image of products, processes, systems and technologies, and the way business is conducted. Thus, sustainable distribution is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors. It also refers to a sustainable logistics which suggests compatibility with the environment. Companies must adopt new environmental policies and carry out sustainable activities as competitive advantage strategies for business survival.

Survey from Aberdeen Group (2008) found that by practicing green supply chain it can help to reduce emissions, reduce waste and improve disposal. Sustainable logistics practices by switching into alternative fuel such as biodiesel and bioethanol can help to give efficient fuel consumption because of this characteristic of alternative fuel. Beside that this fuel is very cheap compared with the other development of other renewable fuel alternative such as hydrogen (Olson & Schuchard, 2014).

The burning of fossil fuels by the logistics industry causes GHG emissions, such as carbon dioxide (CO2) that can have a major negative impact on our

environment and on the general health (Kumar Piaralal, Nair, Yahya & Karim, 2015).

Further, Warehouse Blast in Tianjin, China (12 August 2015) incident is a clear reminder to the chemical industry of the blatant abuse of power and dereliction of duty by the owners and the relevant government agencies. This warehouse sits on a giant logistic hub which is more than twice the size of Hong Kong. At the time of the incident, the warehouse in this complex stored mainly ammonium nitrate, potassium nitrate, sodium cyanide and calcium carbide. The final death toll was 173 personnel of which 97 were firefighters; 11 policemen and 8 civilians. About 474 were injured and receiving treatment of which 7 are in critical condition. The initial estimated cost to clear up the damage was about US7 billion (CICM Malaysia, 2015). In Malaysia, we have adequate laws and regulations covering chemical warehouse safety but more importantly the chemical industry must voluntarily implement appropriate codes and best practices at their chemical warehouses.

Ubeda, Arcelus and Faulin (2011) also found that sustainable logistics practices such as of choice to reduce number of routes, introducing backhauling in logistics activities and design the shortest routes can control the emissions of carbon dioxide emission. This can be very beneficial to the environment and to the society because reduction in this type of gases can help to reduce environmental impact such global warming and at the same time improve the society health status.

Environmental Performance

Klassen and Mclaughlin (1996) found that environmental performance was positively correlated with superior stock price performance. Similarly, firms viewed as environmentally legitimate were found to incur less unsystematic stock market risk than firms viewed as illegitimate (Bansal & Clelland, 2004; Shen, 2009). Nehrt (1996) also found a positive relationship between the timing of a firm's environmental investment and profit growth.

The Environmental Measurement and Auditing System (EMAS), appears to be an excellent EMS to ISO14001, as it requires assessment of its actual environmental performance, rather than just validating the system, and it also requires external checks. However, it has taken a limited time, probably due to these more stringent requirements (Jones et al., 2005). The development of EMS in the organization is evolution. Initial drivers are legal compliance requirements, followed by the focus of pollution control. Over time this emphasis shifts from pollution control (emissions and wastes) to pollution prevention and eco efficiency while leading organizations move to ecological design (through design innovation) with a better step to emphasize sustainability accompanied by a change of process-to-yield emphasis (Kolk & Mauser, 2002).

In measuring the environmental performance, the material use/unit is used as a measure of the efficient use of materials, an issue for all organizations. Energy use/unit and water use/unit was chosen as these are regarded by every scientist working on environment issues as areas where organizations must

reduce usage. Finally, 'emissions' was chosen as this is also an area on which there is no debate that emissions must be reduced. However, for each organization, the specific type of 'emission' would vary. These measurements were adapted from Hubbard, (2009).

Reflecting to the literature review, the following hypotheses have been developed.
H1: There is positive and significant relationship between sustainable distribution practices and environmental performance.

METHODOLOGY

This study made used of quantitative research method by using cross-sectional survey approach because the data collected covered the period of the study only. The population of this study is chemical firms in Malaysia. A total of 500 from 860 chemical firms which registered in Federation of Malaysian Manufacturers were randomly chosen as a sample of this study. The unit of analysis in this study is individual manufacturing firm. In order to get valid and reliable responses, the targeted respondent in this study is personnel who hold a managerial position in a firm at least at the operational or supervisory level and involves in the operational activities. Adopting survey approach, a set of questionnaire was mailed to 500 targeted respondents. In total, 76 responses were gathered from various manufacturing industries giving a response rate of 15.2%. However, three questionnaires need to discard as incomplete. Thus, this study collected 73 completed data samples from chemical companies, which is larger than 52, the minimum requirement of sample size (Cohen, 1992).

A set of questionnaire was developed to collect data in this study. The questionnaire consists of three sections with the first section is on demographic information and the remaining two sections measuring the level of sustainable distribution implementation and environmental performance by responding firms. The operationalization of sustainable distribution practices and environmental performance was based on the combination of scales developed by previous researchers

Due to this study encountered situations (i) small response and (ii) little available theory, PLS-SEM is the most suitable approach to be used. PLS-SEM is a more robust approach and can be used to analyze data with non-normality distribution. Using PLS-SEM, data normality is not a demanded aspect because PLS uses calibration mechanisms, which transform any non-normal data into data that adheres to the central limit theorem (Chin, 1998; Hair, Sarstedt, Hopkins & Kuppelwieser, 2014; Wong, 2013).

RESULT AND DISCUSSION

Analysis on the demographic information of the respondents are presented in Table 6.1. The result of descriptive analysis shows that the majority of the firms are large-sized (49.3%), followed by medium-sized (35.6%) and small-sized (15.1%).

The table also shows that most of responded firms have been established within 10 to 20 years (42.5%). About 31.5% of the firms' state that they have been operating since 21 to 30 years, 16.4% have been operating since 10 to 20 years, while the rest 9.6% of the firms are just operating not more than 10 years. The respondents of this study hold diverse position in the company as we can see, 27.4% of them are manager, 24.7% are Executive and 21.9% are operation manager. Assistant manager, CEO and managing director have equal percentage which are 6.8%, while engineer are 2.7%. The result also shows equal percentage for senior manager and quality manager which are 1.4%. The responded firms consist of different status which are the majority of them (54.8%) are multinational corporations (MNC), followed by 21.9% are from national or local firms (NC) and joint ventures (JV). For the purpose of fulfilling the research focus and objective about environmental management systems, the requirement of at least the responded firms has been adopting ISO 9000 is fulfilled. It can be seen in the table that 100% of the respondents has ISO 9000 certification.

Table 6.1

Demographic profile of respondents.

Characteristics	Frequency	Percent
Firm size		
Small	11	15.1
Medium	26	35.6
Large	36	49.3
Year Established		
Below 10 years	12	16.4
10 to 20 years	31	42.5
21 to 30 years	23	31.5
Above than 30 years	7	9.6
Respondents position in company		
Assistant Manager	5	6.8
Chief Executive Officer (CEO)	5	6.8
Engineer	2	2.7
Executives	18	24.7
Manager	20	27.4
Managing Director	5	6.8
Operation Manager	16	21.9
Quality Manager	1	1.4
Senior Manager	1	1.4
Status		
MNC	40	54.8
NC	16	21.9
JV	16	21.9
ISO 9000 Certification		
Yes	73	100.0
No	0	0.0

Table 6.2
Descriptive statistics of sustainable distribution practices.

Items	N	Min	Max	Mean	SD
D1: Develop and produced chemicals that can be manufactured and transported of safely.	73	3.00	5.00	4.055	.524
D2: Evaluate the risks associated with chemical distribution and methods to reduce those risks.	73	3.00	5.00	4.014	.565
D3: Meet or exceed all regulations and industry standards governing chemical distribution.	73	3.00	5.00	3.767	.541
D4: Provide emergency advice and/or assistance to people on the scene in the event of a chemical distribution emergency.	73	2.00	5.00	3.562	.601
D5: Develop new technologies and methods to improve chemical distribution safety.	73	3.00	5.00	3.603	.546

Table 6.2 above shows the result of descriptive statistics of sustainable distribution practices. The mean ($\bar{x}$) value for sustainable distribution practices range between 3.562 and 4.055 out of a possible value of 5.0 on the scale, demonstrates a moderate to considerable extent of implementation of sustainable distribution practices among chemical firms in Malaysia. This result fulfills the research objective which attempts to investigate the extent of sustainable distribution practices implementation.

Distribution have an important role to play in ensuring the sustainability message is passed on through to the customer, while of course they also need to ensure their own operations meet sustainability goals. The chemical industry also promotes excellence in distribution operations, with the aim of achieving even more efficiency and making better use of available transport and logistics resources. As part of Responsible Care (RC), the chemical industry has made a commitment to continuously improve its safety and environmental performance. Numerous voluntary initiatives have been taken to promote and implement the very best in terms of safety and environmental standards in transport and logistics (CICM Malaysia, 2015).

Most manufacturers and retailers including chemical firms have adopted distribution approach with increasingly outsourcing their logistics activities to logistics service providers. In order to meet demands of their customers and to deliver products and services quickly, many companies sought to outsource their logistics activities to logistics service providers (LSPs). According to (Kanisen & Rohafiz, 2012) the current trend of the Malaysian logistics industry is concentrating in outsourcing of logistics activities and on the growth of third party logistics (3PLs). Third party logistics service providers (3PLs) are known to make a substantial contribution to environmental degradation with transport

and logistics activities contributing significantly to greenhouse gas emissions. It is estimated that there are approximately 22,000 logistics firm providing a variety of services in the logistics industry in Malaysia (Kanisen & Rohafiz, 2012). Whatsoever the reason for eco-friendly distribution practice and other eco-innovation practices being applied, government or regulation compliance, societal and industry demand are believed to be the main reasons for eco-innovation practices implementation.

Previous discussion was highlighted that most processes which involve the use of chemicals have the potential to cause a negative impact towards the environment. It is therefore essential that the risks involved be eliminated or at least reduced to an acceptable level. Traditionally, the risks posed by chemical processes have been minimized by limiting exposure by controlling so-called circumstantial factors, such as the use, handling, treatment, and disposal of chemicals. The existing legislative and regulatory framework that governs these processes focuses almost exclusively on this issue. With the implementation of sustainable distribution practices, it is believed to be able to prevent the destruction of the environment by reducing emissions, waste and improve disposal systems.

While Table 6.3 below shows the result of descriptive statistics of environmental performance. Energy used performance score the highest mean, followed by emissions, effluent & waste, water used, key material used, and toxic chemical. Overall, the mean ($\bar{x}$) value for environmental performance is range from 3.86 to 4.16 for each item out of a possible value 5.0 indicates the ability of the responded firms in performing better environmental performance.

Table 6.3
Descriptive statistics of environmental performance.

Items	N	Min	Max	Mean	SD
E1 Key material used	73	3.00	5.00	3.89	.393
E2 Energy used	73	3.00	5.00	4.16	.553
E3 Water used	73	3.00	5.00	3.90	.581
E4 Emissions, effluent & waste	73	3.00	5.00	4.00	.623
E5 Toxic Emissions	73	2.00	5.00	3.86	.630

Measurement model

The validation of a reflective measurement model can be established by testing its internal consistency, indicator reliability, convergent validity and discriminant (Hair, Ringle & Sarstedt, 2013; Hulland, 1999; Jarvis, Mackenzie & Podsakoff, 2003; Petter, Straub & Rai, 2007). The following table shows the various reliability and validity items that we must check and report when conducting a PLS-SEM.

Overall, after the reliability and validity tests has been conducted, there are 5 out of 10 items (D1, D2, D3, E4 and E5) has been deleted due to low item loadings. However, the reliability and validity tests conducted on the measurement model are satisfactory.

Table 6.4
Reliability and validity of items.

Construct	Item	Loadings	Composite Reliability (CR)	AVE
Distribution Practices	D4	0.713	0.797	0.665
	D5	0.907		
Environmental Performance	E1	0.861	0.759	0.530
	E2	0.812		
	E3	0.433		

All reliability and validity tests are confirmed and this is an indicator that the measurement model for this study is valid and fit to be used to estimate parameters in the structural model.

Structural model

Once the validity and reliability of the construct measures are confirmed, the next step addressed the assessment of the structural model results. There are four steps of assessment procedure need to be followed as suggested by (Hair et al., 2014). The following subsections discuss the four steps of assessment procedure: 1) collinearity; 2) path coefficients; 3) coefficient of determination (R^2); and 4) predictive relevance (Q^2).

Collinearity
High correlations between two indicators is referred as collinearity (Hair et al., 2014). To assess the collinearity, we need to determine the construct's tolerance (VIF) value for each set of predictor variables. Each predictor VIF value should be higher than 0.2 (lower than 5.0). The result of the VIF values for this study shows that the value for predictor, sustainable distribution is 1.14. The values confirm the issues of collinearity is not a problem.

Path coefficients (β) in structural model
Within the structural model, each path connecting two latent variables represented a hypothesis. Based on the analysis conducted on the structural model, it allows the researcher to confirm or disconfirm each hypothesis as well as understand the strength of the relationship between dependent and independent variables. Using the SmartPLS algorithm output, the relationships between independent and dependent variables were examined. The results from the path assessment, shows the value of 0.309 significant at p-value of 0.020 concluded the acceptance of the proposed hypotheses is determined.

Coefficient of determination (R^2)
The R^2 value indicates the amount of variance in dependent variables that is explained by the independent variables. Thus, a larger R^2 value increases the predictive ability of the structural model. In this study, SmartPLS algorithm function is used to obtain the R^2 values, while the SMartPLS bootstrapping function is used to generate the t-statistics values. For this study, the bootstrapping generated 500 samples from 73 cases. Sustainable distribution only explains 9.6% of the variance in environmental performance. The R^2 value

in this study can be considered as low because in consumer behavior research discipline, the R^2 value of 0.2 and above are considered high (Hair et al. 2014). The problem of low or weak R^2 value normally happens due to the availability of other variables which not been included in the research model.

Table 6.5
Coefficient of determination.

Endogenous Variable	R Square
Environmental Performance (EP)	0.096

Predictive relevance
Another assessment of the structural model involves the model's capability to predict. The predominant measure of predictive relevance is the Stone–Geisser's, Q^2 (Geisser 1974; Stone 1974) as cited in (Joe F. Hair et al., 2014), which postulates that the model must be able to adequately predict each endogenous latent construct's indicators. The Q^2 value is obtained by using a blindfolding procedure. If an endogenous construct's cross-validated redundancy measure value (Q^2) for a certain endogenous latent variable is larger than zero, its explanatory latent constructs exhibit predictive relevance. Table 6.6 shows the value of Q^2 for environmental performance (EP) are 0.043. It can be concluded that the model of this study exhibit a low capability to predict.

Table 6.6
Cross validated redundancy (Q2).

Endogenous Variable	Q^2
EP	0.043

CONCLUSION

Sustainability issues have received increasing level of attention both locally and globally. This attention raises questions on what is the current level of sustainable distribution practices implementation. This study has put an effort to investigate the extent of sustainable distribution practices in the Malaysian context and its relationship with environmental performance. The study reveals that the sustainable distribution practices currently has been implemented moderately by chemical firms in Malaysia. The implementation of these sustainable distribution practices then positively and significantly affect the environmental performance. Previous discussion was highlighted that most processes which involve the use of chemicals have the potential to cause a negative impact towards the environment. With the implementation of sustainable distribution practices, it is believed to be able to prevent the destruction of the environment by reducing emissions, hazardous spill, and waste and improve distribution systems. Limitation of this work relates to the cross-sectional data that does not account for the dimension of time, i.e. how long the practices have been implemented. This may be an important consideration as firms who had implemented the practices over a longer time period may have realized greater levels of improvement. This is something that future studies should try to incorporate as it may have an influence on the results. Future research should also include other factors which potentially relates to the sustainable environmental performance.

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